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ABSTRACT

In a recent issue of "Fortune," the leading article carried the predictive title, "The Coming Shake-Up in Telecommunications." Increasingly, the attention of the business community and the general public is being called to the emergence of such new and potentially revolutionary communications technologies as CATV (community antenna television) and communications satellites. Adding new ingredients to the communications mix has a strong catalytic effect, releasing powerful forces which churn up established and long-stable policy matters, raising new questions and reopening old ones. This paper examines those regulatory, technical, and program developments which are a part of the "shake-up in telecommunications," and explores their implications for those planning library and other "public-service oriented" communications networks. Such consideration must include recent and proposed changes in Federal Communications Commission rules and procedures; plans for new commercial special service common carrier networks; the [illegible]ed evolution of CATV into a national system of broadband cab[illegible] communications; and developments in the satellite field In addition, it is important to see that other public and semi-public agencies are interested in network development and to explore what opportunities for cooperative effort and mutual benefits may exist. (Other papers from this conference are available as LI 003360 - 003363 and LI 003365 through LI 003390) (Author/NH)

GROUP A - PAPER 5

TELECOMMUNICATIONS PROGRAMS AFFECTING NETWORK DEVELOPMENT

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TELECOMMUNICATIONS PROGRAMS AFFECTING NETWORK DEVELOPMENT

In a recent issue of Fortune, the leading article carried the predictive title, "The Coming Shake-Up in Telecommunications."[1] Increasingly, the attention of the business community and the general public is being called to the emergence of such new and potentially revolutionary communications technologies as CATV and communications satellites. Most reports focus upon the impressive technical prowess of such new highways for electronic communication and the ways in which the wonders they can work will likely shape the lives we lead and the world in which all live in the future. In his Fortune article, Dan Cordtz documents the consequences which new technologies are already having in the world of communications policy and regulation. Adding new ingredients to the communications mix has a strong catalytic effect, releasing powerful forces which churn up established and long-stable policy matters, raising new questions and reopening old ones.

The purpose of this paper is to examine those regulatory, technical, and program developments which are a part of the "shake-up in telecommunications," and to explore their implications for those planning library and other "public-service oriented" communications networks. Such consideration must include recent and proposed changes in Federal Communications Commission rules and procedures; plans for new commercial special service common carrier networks; the predicted evolution of CATV--community antenna television--

[1] Cordtz, Dan, "The Coming Shake-Up in Telecommunications," Fortune, LXXXI,4 (April 1970), p. 69 ff.

into a national system of broadband cable communications; and developments in the satellite field, In addition, it will be important to see what other public and semi-public agencies are interested in network development, to examine their experience and plans for the future, and to explore what opportunities for cooperative effort and mutual benefits may exist.

The climate for the development of new services and new networks is substantially improved under recent and proposed actions by the Federal Communications Commission. The first such landmark ruling from the FCC was the Commission's "Carterfone decision."[2]

Carter Electronics Corp. is a small Texas firm manufacturing a device which permits mobile radio users to couple their two-way radios into the conventional telephone system. Thomas F. Carter, the company's president, initiated antitrust action in the federal courts to end the telephone companies' long-standing ban on the use of such "foreign attachments" as the Carterfone. In phone company terminology, a "foreign attachment" is any device (whether made in Texas or Tokyo) not leased by--or at least approved by--the phone company. Introducing such devices into the phone system could subject the phone company's network and its customers to a source of potential interference and degradation over which the phone company would have no control. So, at least, the rationale ran. The result, however, was not only to reduce potential sources of interference, but also potential freedom of choice by telephone subscribers who found themselves limited almost

[2]Federal Communications Commission Dockets No. 16942, 17073.

exclusively to those devices which the phone company was willing to provide on a lease basis.

The courts referred the case to the Commission, which, in a unanimous vote in June 1968 found little reason for the carriers to enforce any blanket prohibition. The burden of proof regarding interference with the integrity of the telephone network is now upon the phone company, rather than upon the subscriber. In general, the telephone company must establish that a foreign attachment will be harmful before it can prohibit the customer from using it; whereas before the telephone subscriber had the difficult task of demonstrating to the phone company's satisfaction that it would not degrade the telephone service.

The Carterfone decision has opened up to competition the broad field of telephone attachments. The user may now choose among a vast array of telephone instruments, ranging from the pseudo-antique to space-age modern, transistorized switchboards for office use, and data modems among other attachments. Further, and equally important, the subscriber may often have the freedom to buy such terminal devices outright instead of having to lease terminal gear from the carrier.[3]

The ability to combine new equipment with existing carrier facilities has resulted in some innovative efforts to develop and market new communications services. An example of such service is "telemail," or intercity

[3]See Final Report of the President's Task Force on Communications Policy, (Washington, D.C.: Govt. Print. Off., 1968), Chapt. VI, p. 26-28, 37-42.

facsimile service for hire. Like crocus buds after a spring rain, a number of "telemail" companies have sprung up since the Carterfone decision. Some appear to have suffered from financial and perhaps managerial malnutrition, and none is yet very large. The service they attempt to perform does, however, appear to fill a genuine need, and one or more public facsimile networks may yet find market viability. Such services are born of the marriage of commercially available facsimile ("fax") equipment and the public telephone network.

For some years such companies as Alden, Xerox, Graphic Sciences, and others have offered machines which permit the transmission of "hard copy" between points interconnected by telephone line. Typically, a memo, graph, or engineering drawing is clipped around the drum of a desk-top device, while at the receiving end a blank sheet is inserted in a similar machine. When the start button is pressed on the sending fax terminal, both drums turn in synchronization and in a few minutes the original document is reproduced at the receiving location. Greatest users of such devices have been those concerned with intra-company communications. The new entries in the communications field have added the flexibility of multiple address capacity.

The use of a public facsimile network might be a business man in Las Vegas anxious to return a signed copy of a contract to the main office in Los Angeles, an engineering consultant in New York wishing to discuss specifications with a manufacturer in Chicago, or an architect wishing to get his artist's renderings into the hands of a potential client. The common need is to move graphic materials from one point to another with greater speed than the U.S. Mails can assure and at smaller cost than

courier service entails.

The customer takes his document to the local office of the fax network, or has it delivered by messenger. The fax service notes the destination and places a long-distance call to the proximate network office or franchisee. The telephones are placed in the acoustic coupler on each fax machine and the document is transmitted. The receiving fax network station calls the addressee to advise him that there is a message to be picked up, or it is delivered by messenger. Typical total time between delivery of the original document to the sending station and delivery of the copy to the addressee: one-and-a-half hours. Typical cost: a few dollars a page, plus the cost of the long distance phone call. Some public fax networks will store-and-forward, sending documents at low volume times when late night phone rates apply.

There are still objectives yet to be met. Facsimile machines are not standardized and so different networks using differing equipment cannot interchange messages. The U.S. Postal Service has many more Post Offices than any existing facsimile network has stations. Transmission speeds will need to be raised and costs lowered before "telemail" becomes a conventional means of sending messages, rather than merely being a helpful device in a crisis.

Whatever shortcomings such a service may manifest in its infancy, the technique of combining available technology and the public telephone system would not have been possible in the same way before the Carterfone decision. Both the principle and the specific example should provide food for thought to planners of interlibrary communications.

Of equal or greater importance is the FCC's "MCI decision"[4] which authorized construction of the first of what many expect to be a whole new class of common carrier networks.

Intercity traffic on the AT&T system is carried both by wire and by microwave relay. Operating at frequencies far higher than those which carry broadcast radio and television signals, microwave systems can carry impressive payloads of information, from multiple telephone conversations to television signals. Since the late 1940's, the rural spaces between our cities have sprouted a substantial crop of tall red-and-white towers. Many belong to the American Telephone and Telegraph Company and are an essential part of Bell's Long Lines system. The Commission has also licensed others to private users, although few enterprises can support or fill the capacity of a private system. The growth of Community Antenna Television systems resulted in the Commission giving its approval to the establishment of a third category of licensee, Community Antenna Relay Systems. CARS, as the trade calls them, pick up the signals of big city television stations and carry them--sometimes hundreds of miles--to the CATV system for delivery to its subscribers. Thus cable TV subscribers in Lafayette, Ind., see not only the signal of the city's lone TV station, but also those of the stations in Indianapolis and Chicago.

"MCI" are the initials of Microwave Communications, Inc., then a

[4]Federal Communications Commission 69-870m re Microwave Communications, Inc., Docket 16509.

fledgling company which applied for a microwave system paralleling the route between St. Louis and Chicago long ago granted to AT&T. While the basic premise of common carrier as a regulated monopoly opposes duplicative routes, MCI argued that it would be the nation's first "special service common carrier," offering new services with higher reliability and lower tariffs than currently offered by the Bell System. The MCI service would be point-to-point, like private lines, between two or more plants or offices designated by the customer, and while voice (and even video) service would be available, the primary target of the MCI proposal is service to computer users. With service "customized" to fit the particular needs of each client, MCI proposes channels as narrow as 200 cycles for costs as low as five-cents-a-mile. Other options not regularly available from the traditional carriers would include asymmetrical circuits (broadband-high capacity in one direction, narrow-band voice or teletypewriter in the other), lease of circuits on less than a full-time basis, pooling of service among customers, and the like.[5]

The Commission's grant of the St.Louis-Chicago route to MCI represented a policy swing in favor of admitting new carriers offering new services. While the Bell System and the existing telephone companies may continue to be the "only telephone company in town," they may not continue to be the only "anytime, anything, anywhere" network.

The FCC approval of the MCI application came only after a bitter fight from AT&T and was a considerable surprise to those observers of communications

[5]Federal Communications Commission, Docket No. 18920, p. 6-9.

regulation not given to placing heavy bets on the underdog, no matter how attractive the odds. More significant than the looks of surprise which resulted from the FCC action was the spate of new microwave common carrier applications which loosening the floodgates unleashed.

By mid-July, 1970, more than 1700 applications for specialized microwave service had been received by the Commission. Chief among the applicants were those from Microwave Communications of America, a company which interlocks with MCI, and the Data Transmission Corporation. Each proposed a brand new coast-to-coast microwave network. MCA is the keystone in a group of regional companies, including MCI. Together these locally-owned regional operators would comprise a national special service common carrier network, with Microwave Communications of America acting as national sales agent.

Data Transmission Company ("Datran") is a wholly-owned subsidiary of University Computing Company. Datran proposes to build a $375-million network, linking thirty-five major metropolitan areas. The Datran system would provide terminal-to-terminal switched service, designed specifically and exclusively for the transmission of digital data. At very least, such proposals offer the planner of interlibrary networks the prospect of new services, greater flexibility in acquiring communications channels well-suited for his particular needs, and the additional hope of more attractive prices.

The development of the special service common carrier field is presently suspended between present disappointment and future promise. As of this writing, Mircowave Communications, Inc. has yet to construct its

first tower for the St. Louis-Chicago route, the only SSCC authorization which the Commission has made. AT&T, whose opposition is undimmed by the Commission's grant to MCI, is still seeking court action to block the actual construction of such a system. All of the other applications, from Microwave Communications of America's associated companies, University Computing's Datran and other, less-than-national, applications are just that - applications. Some appear to be mutually-exclusive and most, if not all, are opposed by the existing common carriers: AT&T, Western Union, the independent telephone companies, and others.

On July 17, 1970, the Commission issued "Notice of Inquiry to Formulate Policy, Notice of Proposed Rule Making, and Order" in Docket No. 18920.[6] The purpose of the inquiry is to resolve broad policy and procedural questions in handling the present and anticipated special service microwave applications. In essence, the Notice makes public an in-house analysis prepared for the Commission by its Common Carrier Bureau. The "threshold" question is stated this way:

> Whether as a general policy the public interest would be served by permitting the entry of new carriers in the specialized communications field. . .[7]

[6] Cf. Block, Victor, "Inside the FCC Common Carrier Bureau," Telephony (15 August 1970), p. 17 ff.

[7] Federal Communications Commission, Docket No. 18920, p. 13.

The Common Carrier Bureau holds that the answer to the "threshold" question is affirmative since, in its view, competition appears to be "reasonably feasible." As summarized in the FCC's announcement:

> In support of its position that the entry of new carriers into the field of specialized communications would serve the public interest, the Bureau noted that the demand for all types of communications services was growing very rapidly, and that data communication would probably exhibit very substantial growth over the next decade. It said that the entry of new specialized carriers would help meet the increasing public need for diverse and flexible means for satisfying expanding specialized communications requirements. The Bureau also stated that new entries would have the effect of 'dispersing somewhat the burdens, risks and initiatives involved in supplying the rapidly growing markets for new and specialized services; 'might stimulate technical innovation' and could 'provide a useful regulatory tool which would assist in achieving the statutory objectives of adequate and efficient services as reasonable changes.'[8]

If the threshold question is resolved in the manner suggested by the Common Carrier Bureau, the Commission might then be free to dispose of the

[8] Federal Communications Commission, "Procedures and Policies for Handling Microwave Applications for Specialized Common Carrier Services Proposed by FCC," Report No. 90 (51530), 15 July 1970, p.2.

need for holding comparative hearings among the various applicants and decline to hear arguments about the economic impact new carriers might have upon old, or upon each other. The Commission could move expeditiously to grant the applications of all applicants who meet basic legal, technical, and financial tests, and let the economic forces in the market place determine which systems are built and operated by whom. The Commission noted that Datran's proposed system differs substantially from the others in being all digital and switched and should, in any event, be considered separately.

The entry of new carriers into the communications field may be expected to have at least two effects which should be beneficial for developers of library and information networks. On the one hand, the potential availability of alternate choices promises the network planner greater flexibility and freedom of choice and offers the hope of securing network facilities closely tailored to the user's needs. "Shopping for best price" may also be possible to a degree not now known. The second effect which is already being felt is the restructuring of offerings and tariffs by the Bell System in response to the same growing needs which the new carrier applicants reflect. Some new options, such as sharing of long distance circuits, are now available, and it is reasonable to expect that more will be offered.

Another area of rapidly changing regulation by the Federal Communications Commission is that of cable television. CATV, as it has generally been known to this point, had its origins in the small towns of Oregon and Pennsylvania where enterprising retail television set dealers installed receiving antennas atop the nearby hill, and brought the signals of the distant city TV stations into the previously "shadowed" valley

communities. Community antenna television still consists, basically, of a well-located antenna installation (now often both sophisticated and expensive), and a web of coaxial cables which transport the signals from the "head end" to the subscriber's set.

While CATV was limited to extending the range of broadcast TV stations into distant small towns, neither the FCC nor the broadcast stations took more than a passing interest. Now, however, the picture has changed in two ways: one, the growth of cable television systems in such cities as San Diego, California, has given indication that CATV may be viable, even where local television signals are available off-the-air. Cable television systems are either in operation or planned for New York, Los Angeles, Chicago, Philadelphia and most of the nation's largest cities. Two, the evolution of CATV into a much more significant communications system is widely predicted. CATV uses coaxial cable, about the diameter of a pencil, to carry the signals of local and distant television signals to the homes of subscribers. The capacity of coaxial cable is far from exhausted by such use, and the basic CATV system might, with relatively minor modification, be used to provide the electronic pathways for a wide variety of additional services.

In light of both these facts, the Federal Communications Commission has launched on a complex investigation of what role the FCC should appropriately take in regulating the growth of cable communications.[9] One hard knot in the

[9]Federal Communications Commission Docket No. 18397.

complex of problems is that of untangling the regulatory roles of the municipalities and the states vis-a-vis federal control and in relation to each other. Several states, including Nevada, Connecticut, New York, and Virginia have passed or are considering asserting state jurisdiction. The inter-relationships among the various levels of governmental regulation are the subject of another FCC Inquiry.[10]

In yet another docket, the Commission seeks comments upon the technical standards to which cable systems should be built.[11] The Commission notes that it "must consider the future possibility of a nationally as well as internationally connected cable grid which will cater to a variety of sophisticated communications needs."[12] This same Notice of Proposed Rule

[10] Federal Communications Commission Docket No. 18892; see also Leland L. Johnson, The Future of Cable Television: Some Problems of Federal Regulation, Memorandum RM-6199-FF, Santa Monica: Rand Corp., Jan. 1970.

[11] Federal Communications Commission Docket No. 18894.

[12] Ibid., p.2.

Making also makes clear the FCC's intention to require that cable operators so design their systems as to provide the possibility of two-way communication. Some of the services which might be possible over an interconnected cable network with two-way capability were suggested by the Commission in its First Inquiry and Notice of Proposed Rule Making:

> It has been suggested that the expanding multi-channel capacity of cable systems could be utilized to provide a variety of new communications services to homes and businesses within a community, in addition to services now commonly offered such as time, weather, news, stock exchange ticker, etc. While we shall not attempt an all-inclusive listing, some of the predicted services include: facsimile reproduction of newspapers, magazines, documents, etc.; electronic mail delivery; merchandising; business concern links to branch offices, primary customers or suppliers; access to computers, e.g., man to computer communications in the nature of inquiry and response (credit checks, airlines reservations, branch banking, etc.), information retrieval (library and other reference material, etc.) and computer to computer communications; the furtherance of various governmental programs on a Federal, State and municipal level, e.g., employment services and manpower utilization, special communications systems to reach particular neighborhoods or ethnic groups within a community, and for municipal surveillance of public areas for protection against crime,

fire detection, control of air pollution and traffic; various educational and training programs, e.g., job and literacy training, pre-school programs in the nature of "Project Headstart," and to enable professional groups such as doctors to keep abreast of developments in their fields; and the provision of a low cost outlet for political candidates, advertisers, amateur expression (e.g., community or university drama groups) and for other moderately funded organizations or persons desiring access to the community or a particular segment of the community.[13]

One area of particular interest to those concerned with the development of library networks is that of access to such systems for public and noncommercial services. In Canada, the government now requires that CATV systems make available at least one channel for the presentation of educational and instructional programs by local authorities. In this country, the Joint Council on Educational Telecommunications and others have urged that 20% of the capacity of each cable system be made available without cost to noncommercial users.[14] The JCET chose the phrase "20% of system capacity" carefully to reflect the interest of what may be broadly defined as "the

[13] Federal Communications Commission Docket No. 18397, Notice of Proposed Rule Making and Notice of Inquiry (FCC 68-1176), p. 5.

[14] Joint Council on Educational Telecommunications, Comments, (12 May 1969) in FCC Docket No. 18397.

educational community" not only in conventional television but in such other services as the Commission, itself, suggests in the paragraph quoted above. Not all of our present needs, and still fewer of our future requirements are likely to be definable in terms of "television channel."

If our future communications options will be greatly expanded by the development of cable communications along and under the ground, the other development of overwhelming significance will surely be 22,300 miles above the Equator--the "parking orbit" for geosynchronous communications satellites. The technology of communications satellites is already well developed, as any viewer of the evening news on television can attest. In international communications, satellites have already established their place. The use of satellites for communications within the boundaries of our own nation has yet to begin on any but an experimental basis. The questions to be answered are not technical, but regulatory.

Since 1966, the FCC has been considering the questions which it raised in Docket 16495 on domestic communications satellites. In essence, they deal with such matters as whether the Communications Satellite Act reserves to Comsat the entire field of satellite communications, or only the international segment, whether others may be permitted to operate domestic systems, and, if so, what others. On several occasions, it has appeared that the FCC would issue some tentative or final word, but each time the President asked for time to study the matter within the Executive Branch. Lyndon Johnson, in a

Congressional Message on August 14, 1967, established a President's Task Force on Communications Policy and charged it with exploring this and other important policy questions.[15] The Task Force's Report was delivered to the President after his announcement that he would not run again, and was never endorsed or acted upon by the Johnson Administration.

The new administration provided an opportunity for yet another look at the matter, and an in-house study group within the Nixon Administration was appointed under the chairmanship of Dr. Clay T. Whitehead, then staff assistant to the President and now Director of the new Office of Telecommunications Policy.

The LBJ Task Force recommended that a pilot program be undertaken with Comsat acting as trustee until final ownership questions could be resolved. The new administration's Whitehead committee took a different view. In a White House Memo to FCC Chairman Dean Burch, the Administration suggested that free entry into the market be maintained, and that there appears to be little reason not to allow any entity, including user consortia and governmental agencies from entering the domestic satellite field, so long as they can demonstrate fiscal and technical capability.[16]

[15] The President's Message to the Congress, 14 August, 1967, in Weekly Compilation of Presidential Documents, III, 33, p. 1146-1154.

[16] White House Memorandum for the Hon. Dean Burch, Chairman of the Federal Communications Commission, 23 January 1970.

Yet another important policy decision appears on the horizon. In June, 1961, the International Telecommunications Union, the UN-affiliated body which deals with allocation of the radio spectrum, will hold a World Administrative Radio Conference on Space Telecommunications. The WARC-ST, as it is more familiarly known, will hammer out agreement among the 190-plus member nations regarding what frequencies are to be used in satellite services, and for what purposes. Much of the deliberation will involve sophisticated questions of electronics and satellite engineering, but the resolution of such questions has its effect upon the potential uses and users of space-borne communications.

Not all frequencies are equally satisfactory for satellite communications use. The JCET and others have been urging that the American delegation to this important world body support the allocation of 2500-2690 MHz for non-commercial communications, including but not limited to ETV transmission to community receivers and terrestrial ETV stations. Data and facsimile transmission are specifically suggested, and communications among libraries could become a significant type of traffic.

The case put forth by the Joint Council on Educational Telecommunications rests upon three contentions:

1. These are very efficient frequencies for space transmission, and would permit the development of ground terminals within the reach of the educational community, perhaps as low as $150-750 in quantity production.
2. The opportunity for experimentation is close at hand, NASA already having received a proposal for an experimental ETV transmitter

The FCC is an independent regulartory agency, and it need not follow the dictates of the White House. Its Notice of Proposed Rule Making, however, did heed, at least in part, the suggestion of the Administration.[17] The Commission has "opened the door" to applications for a domestic satellite system, reserving judgment until such applications have been reviewed as to whether it will ultimately grant one, some, all or none. At this writing, only one such application has been submitted, that from Western Union. A wide variety of other parties have informed the FCC that they also intend to submit plans. The group includes Comsat, AT&T which will submit its own proposal or may choose instead to be Comsat's chief customer, Hughes Aircraft, the leading builder of communications satellites, and TelePrompTer Corporation, leading cable TV concern (separately or jointly), and both of the leading special service common carrier applicants, Datran and Microwave Communications of America.

Favorable action by the Commission on any of these applications could, at very least, increase competition in the carrier field and perhaps offer alternative choices for national network development. One interesting consideration is that satellite communications (at least their space segment) are essentially distance independent. That is to say that any two earth terminals in view of the satellite can be connected at equal cost. A "hop" from Washington to Baltimore, or from Washington to Fairbanks is much the same in technology, and in cost.

[17] "Sky's the limit on satellite bids," Broadcasting, 78:13 (30 March 1970) p. 42.

which could deliver a powerful signal in this band. The experiment could be carried out on NASA's ATS-G satellite.

3. The 2500-2690 MHz band is now allocated in this country to the non-commercial Instructional Television Fixed Service (ITFS) and by allocating the same frequencies to education for space and terrestrial use, interference to existing ITFS systems could be minimized, and beneficial trade-offs negotiated among parties with common interests.

Education's fight for these frequencies is by no means won, either in this country or at the international level. The opportunities which could be opened for low cost distant-independent communications should be as attractive to library and information science specialists as to those interested in educational and instructional TV.

An examination of the regulatory framework within which telecommunications exists reveals, then, that "the coming shake-up" will include new answers to some presently-pressing questions. As the Federal Communications Commission has already cast aside previous restrictions upon what devices the system user may connect to the public telephone network, it appears also to be moving toward admitting to the common carrier field a host of new entities which would seek to carve out their places in the common carrier field by offering new and different services in an expanding communications market. Most of the issues have yet to be finally resolved in the special service common carrier field; they same may be said even more emphatically with regard to cable communications and to domestic satellites. It is already clear, however, that any one of these developments, singly, would

have enormous impact in the communications field. Such technological developments coming at the same time assure that it will soon be "a whole new ballgame," in which there are not only new players but new rules of play. Any forward planning for library and information networks which ignores such developments can only find itself out of date before it can be implemented.

The technical developments which give rise to such pressing regulatory questions are of interest in their own right. The technical capacities likely to be offered by new carrier networks, cable communications, and satellites have already been suggested, but a brief look at each would not be out of order.

The development of coaxial cable-based Community Antenna Television brings to the CATV-connected home or office a technology of considerable power. While most present CATV systems carry only twelve channels of TV, the capacity of the cable itself is considerably greater. The present "bottleneck" is the tuner of the TV set, designed to tune only twelve VHF channels, numbered 2-13. The cable, itself, can carry frequencies from a few cycles per second to approximately 300,000,000. In TV terms, that would provide some channels below Channel 2, more between Channels 6 and 7 which, although numbered consecutively, "jump over" enough room for nine more channels, and above Channel 13. The capacity of present cables is impressive, and it is not unlikely that future systems will be able to transmit UHF as well as VHF frequencies.

To escape the problem of the conventional TV set's limited ability to retrieve all that the cable could offer, some CATV systems have gone to

20 or more channels, issuing to each subscriber a small tuning device which sits atop the TV set like a UHF convertor of the 1950's. While each CATV cable may someday be able to carry a wider range of frequencies, it is possible right now to install more than one cable. Two cables, side by side, will carry twice as many signals, and all the viewer need do is to throw a switch on his CATV tuner which connects him to Cable A or Cable B. In San Jose, California, a system is now under construction which will use this simple solution to provide a total of 42 channels. If such communications capacity does not appear to be sufficient to meet your wildest dreams, one might consider the fact that one Rand Corporation expert predicts systems of better than 400 channels.

Four hundred channels of television may appear more likely to stupify than to inspire. With the possible exception of those TV fans who would welcome the prospect of choosing <u>any</u> "I Love Lucy" episode they might wish to see at any hour of the day or night, 400 channels of TV may appear to be more than the good of the human race actually requires. The more rational view, of course, lies in the fact that such immense communications capacity need not all be devoted to entertainment TV. Some of the communications options, especially with two-way communications, are already suggested in the quotation from the FCC's Docket 18397 above. The comments by the Industrial Electronics Division of the Electronics Industries Association in Docket No. 18397 are illuminating. EIA envisions a broadband communications network (BCN) which would include a minimum 300 MHz "pipe" to provide many information services for home, business and government such as broadcast video, first-class mail, and educational material, plus others. . .

The BCN should provide limited return bandwidth for receiving and tabulating specific requests and responses by individual users of the cable or cables."[18]

Such a return circuit would permit the user to order and control what information was sent him. One example is described in the following quote:

> The principal elements of the BCNX electronic mail can also provide a new service to the home or business user. This may be called the electronic home library service (designated BCNL). With such a service available a reader can request a book or periodical from a large central library, using a narrow-band channel to the library (a phone circuit of the BCN network itself.) The desired book is then "transmitted" from microfiche, microfilm, or video tape, page by page, and received via the BCN network on a dedicated wide-band channel.
>
> Several modes of operation are possible. In one, the entire book or a selected article is transmitted at the maximum reception speed of the user's facsimile recorder. Several hundred simultaneous transmissions in time-division multiplex are possible with 6-BCN channels and reasonable recorder speed.
>
> As an alternative, a soft-copy display can be used. Each page is transmitted and stored at the receiver for reading. When the reader has finished one page, he signals for the next page, and this is transmitted in a small fraction of a second

[18] Electronic Industries Association, Comments in FCC Docket 18397, Part V (28 October 1969), p. 2.

with no perceptible delay. This is another form of sharing of the broad-band channel.

To get a feeling for the capacity of a broad-band channel, it is of interest to note that in the demonstration described in Reference 5, the entire text of "Gone With the Wind" was transmitted in facsimile over a television microwave circuit in slightly over two minutes.

In its early stages a library service would undoubtedly be limited in quality of the recorded images. The goals of graphic arts quality, color reproduction, and other refinements will gradually be attained as technology advances and as public demand develops. BCN offers a favorable transmission medium in bandwidth and propogation characteristics for such growth in image quality. [19]

Furthermore, it has been suggested that the introduction of computer-based switching into such a system could add greatly to its flexibility and utility. The computer could store an "interest profile" for each subscriber, based upon the user's own statement of his information needs, plus the computer's memory of what he has ordered in the past. Each night, the computer would search its record of the day's new acquisitions, match them against the interest profile of each subscriber, and print out at each terminal a list custom-tailored to the individual needs of the subscriber,

[19] Ibid. p. 20-21.

including, perhaps, a precis for those items judged likely to be of greatest interest to the subscriber.

The near-miracles promised by a cable communications system sound impossible to resist, but it is also clear that there are costs, economic and political, which would have to be met. The barriers to the wide-spread development of cable communications, and the economic costs which would be entailed were examined by Harold J. Barnett and Edward Greenberg in a paper prepared for a 1967 conference sponsored by Resources for the Future, Inc. and The Brookings Institution. These Washington University economists coined the name, "the Wired City," which has since garnered wide use to describe the potential of cable communications.[20]

If it appears that the full implications of cable communication were not foreseen by those who pioneered in CATV, it is equally true that the potential of communications satellites was clearly seen by the Congress when it passed the Communications Satellite Act of 1962. In creating Comsat as this nation's chosen instrument in the field of satellite communications, the legislation clearly intends that Comsat should serve this role in the international communications field. The application of communications satellites to domestic communications then appeared so wildly futuristic that the subject is even discussed in the act.

The Communications Satellite Corporation, to give Comsat its full name, was chartered as a non-governmental corporation, the stock of which

[20] Barnett, Harold J. and Edward Greenberg, "A Proposal for Wired City Television," Washington Univ. Law Q. 1968: 1 (Winter 1968), p. 1-25

is held by both the international common carriers and public stockholders. By international agreement, Comsat also serves as manager of the International Satellite Consortium (Intelsat), the multi-national agency which operated the international communications satellite system. Educators and librarians, and, indeed, any private party, are barred from dealing directly with Comsat by the "authorized user" regulation which restricts Comsat to the role of communications wholesaler, providing satellite services only to authorized common carriers. Thus, to lease a circuit between London and New York, the television networks deal with AT&T here, and the British Ministry of Posts and Telegraph at the other end of the circuit.

The domestic communications satellite proposal which the FCC has received from Western Union bears a strong technological resemblance to the present Comsat-Intelsat configuration: relatively small multichannel, multipurpose satellites, working into a small number (five in the WU plan) of large and expensive earth terminals. Such communications satellite systems are termed "relay" satellites.

Engineers distinguish "relay," "distribution," and "broadcast" satellites. Relay satellites, including those now in use, are designed to handle point-to-point traffic on high density routes, as between North America and Europe. The traffic begins and ends its journey via terrestrial common carrier systems, so that only a few ground terminals are needed, each connecting to a terrestrial web for carrying the messages onward.

True broadcast satellites could beam radio and/or television programs directly to the home. Such programs would be received on conventional receivers with, perhaps, minor modifications and special outdoor antennas.

At present no broadcast television satellites exist. The technical problems may take five to twenty years to solve; the political problems, inherent in any system which would make it possible to beam TV directly both to and from unfriendly nations, may never find solution.

Between these two extremes lies the "distribution" satellite, the next logical step in communications satellite development. That step is already possible, and is planned for sometime in the 1973-74 time frame. NASA's Applications Technology Satellite F will carry, among other experiments, a solar-powered 80-watt TV transmitter, whose power will be concentrated by ATS-F's 30-foot antenna into a relatively narrow, intense, beam which will be focused upon India. There, under an agreement between the governments of India and the U.S.A., schools and community centers in 5000 Indian villages will receive educational television programming for children and adults on special TV receivers which will cost, in those quantities, something on the order of $500. The programs, produced by the Indians themselves, will be beamed up to the satellite from near Bombay, and retransmitted into the village sets.

There are technical reasons why that particular experiment cannot be carried out in the United States, largely having to do with the fact that the ATS-F will broadcast its signals in the UHF frequencies. There is no ground-based UHF television in the Indian subcontinent. Here, the satellite would be a potential source of interference with American TV stations on Channels 14-83. However, at least one proposal would offer the possibility of a parallel experiment for the USA--including, perhaps, Alaska and/or Hawaii.

ATS-G is scheduled to follow ATS-F by eighteen months to two years. The

ATS-G proposal would provide an even more powerful TV transmitter in the 2500 MHz band, a set of frequencies so desirable for educational communications that the JCET, the Department of Health, Education and Welfare, and others have urged that they be made available on an operational basis.

This ATS-G proposal would permit TV or other broadband communications (such as highspeed data transmission) from the satellite into simple receiving antennas estimated to cost approximately the same as those in the Indian experiment. One important addition in this case, however, would be the option of adding two-way communications from any receiving point. The return channel would not be capable to television, but could accommodate voice transmission--allowing a viewing student in Kodiak, Alaska, to ask a question of his TV teacher in Los Angeles--or such other narrowband communications as teletypewriter signals. Both computer access and facsimile transmission would be well within the range of possibility.

The importance of such an advance in communications satellites to library and information network planning is immediately obvious. Since satellite communications are distance independent, this communications technology makes the task of interconnection of five libraries with similar specialized collections but widely disbursed geographically exactly the same as that of interconnecting five libraries in a single state. When connected via satellite, the terrestrial distances between terminals is simply not significant. The President's Task Force on Communications Policy pointed out that there are two characteristics of communications satellites which have no exact terrestrial equivalent: their ability to provide multi-point distribution via a single relay point, and their ability to reallocate communications capacity flexibly and rapidly among a number of individual

routes. Such flexibility increases as the number of ground station increases. Such a system might well prove economically and operationally attractive for establishing a variety of specialized communications "networks" such as multiple-access, variable information rate data exchange service, computer-aided educational services, and occasional, specialized video "networks."

In addition to television distribution, uses of communications satellites in the foreseeable future might thus include: (a) relay of bulk communications such as multi-channel voice/record trunks, high speed data, and video programs among a limited number of points; (b) networking of specialized communications such as voice, data, and graphics among dispersed or mobile users, such as aircraft, ships, computer and information centers; and (c) various scientific and meteorological data collection, distribution and exchange services. Satellites might, therefore, open new horizons in the dissemination and exchange of economic, medical, scientific and educational information among businessmen, doctors, students, teachers and others, and lend added impetus to progress in many areas.[21]

To provide service to low-cost earth terminals, a communications satellite system must be able to develop satellites of higher power than has been

[21] Final Report of the President's Task Force on Communications Policy, (Washington, D.C.: Govt. Print. Off., 1968) Chapt. V, p. 5-6.

heretofore possible. For a whole complex of reasons, the choice of transmission frequencies used from space is an important factor, and the proposals for NASA's ATS-F and ATS-G satellites demonstrate that greatly increased levels of signal strength can be achieved if frequency selection is optimized. It is for this reason that the work of next year's World Administrative Radio Conference on Space Telecommunications will be of critical importance, Thus the Joint Council on Educational Telecommunications, the Department of Health, Education and Welfare, and others are urging that the best choice of frequencies not be denied to services such as those outlined by the President's Task Force.

One final word on satellite communications is in order. On June 13, 1969, the National Aeronautics and Space Administration held a meeting at which it announced the availability of two early satellites in the Applications Technology series. The experimental programs for which ATS-I and ATS-III were originally launched had been substantially completed, and NASA invited parties interested in undertaking new experiments, and willing to fund the programmatic costs involved, to prepare and submit proposals. At the meeting, a series of proposals was put forth by John W. Macy, Jr., on behalf of the Corporation for Public Broadcasting, of which he is the president, the Ford Foundation, the Joint Council on Educational Telecommunications, the National Association of Educational Broadcasters, and National Educational Television.

The proposals of the ad hoc Satellite Task Force deal not only with use of the satellites for television transmission, but for an experimental

radio network, as well.[22] Of great significance to planners of library and information networks is the fact that these satellites can receive and transmit such narrow-band traffic as voice or data through the use of simple and relatively inexpensive earth terminals. Like the public broadcasters, the State of Alaska and the Lister Hill National Center for Biomedical Communications, National Library of Medicine, have also received NASA's agreement to use ATS-I or III for experimental purposes. Opportunities for interlibrary communications via satellite are already available, and demonstrably feasible costs. The idea of a library and information network experiment on ATS-I and III would appear much worth pursuing. Plans might be made directly with NASA, or as a part of one of the experiments already proposed by public broadcasting, the State of Alaska, or the Lister Hill Center.

The most important lesson to be learned is of far greater importance than the satellites, themselves. It is that planners of interlibrary networks need not, and should not, labor alone. This Conference on Interlibrary Communications and Information Networks is an important step toward exploring new opportunities for mutually beneficial cooperation.

Outside the federal government, itself, the educational broadcasting community has been the most visible, and probably the principal, user of public-service oriented networking. A brief review of some of the major entities, their acronyms, and their activities in networking may help to put educational broadcasting in perspective.

National Educational Television (NET) has been the most familiar organization in public television since the early days of ETV. (The term,

[22]"A Proposal for Experimental Use of ATS," in John W. Meaney and C. Ray Carpenter, eds., Telecommunications: Toward National Policies for Education, (Washington, D.C.: Joint Council on Educational Telecommunications, 1970), p.147 ff.

"public television" was first applied by the Carnegie Commission in an attempt to find a substitute for the more academic and forbidding "educational TV.) For most of its existence, NET has not been a "net" in the true sense of the word, but a producer and distributor of video tape recorded programming. NET, long based in New York City, is now in the process of merger with New York's local public television station, WNDT (TV). The surviving corporation will be the WNDT licensee, the Educational Broadcasting Corporation, but the NET presence will be echoed in the station's call letters, which are to be changed to WNET.

The stations, themselves, are members of the National Association of Educational Broadcasters, the pioneer organization in educational radio and television. The NAEB's membership includes educational radio and television stations, schools and universities, and individual practitioners in the field. Its Educational Television Stations (NAEB/ETS) division serves the nation's public television stations, through the ETS Program Service, acts as a clearing house of the exchange of programs produced by individual stations. NAEB's radio division, National Educational Radio, has for many years operated a program service "network" distributing radio programming on tape.

In both radio and television, some true intra- and inter-state public broadcasting networks exist. All of the State of Wisconsin is served by its pioneering state-owned FM radio network. Several states operate statewide television networks, and one, South Carolina, combines both closed-circuit television to the schools with a network of broadcast ETV stations. The principal state agencies are represented in NAEB's Council of State Educational Telecommunications Authorities (COSETA).

Genuine networking, in the form of live coast-to-coast real-time interconnection for public broadcasting is an old dream, but a relatively recent reality. The Ford Foundation (long ETV's strongest supporter), backed this nation's first true public television network in a two-season project called the Public Broadcasting Laboratory. PBL has passed from the scene, but the experimental one-night-a-week interconnection of ETV stations has expanded to six nights per week and to more stations. The networking is accomplished over leased Bell System facilities. While the Public Broadcasting Act clears the legal decks for "free or reduced rate" service, the debate over the degree of cost reductions has not yet been agreed upon. Support for the present network comes from the Ford Foundation and the Corporation for Public Broadcasting.

The Corporation for Public Broadcasting was created in response to the recommendations of the Carnegie Commission on Educational Television. Although chartered by the Congress, the CPB is not an agency of the government. Its Board of Directors is appointed by the President, and it receives the major share of its funding by Congressional appropriation. Its task is to promote the development of noncommercial radio and television as a national resource. To carry out that mandate, it makes grants to stations and regional networks, and has played a key role in the establishment of other national agencies in public broadcasting. Of particular interest to planners of information networks are two new agencies on the public broadcasting scene:

The Public Broadcasting Service has been created to assume operational responsibility for the public television interconnected network. The function begun by the late Public Broadcasting Laboratory and more recently

administered by NET will become the full responsibility of the new PBS. While the Board of Directors of the Corporation for Public Broadcasting is appointed by the President of the United States, the PBS Board consists principally of public television station managers, elected by their peers from across the nation. Although yet in the process of recruiting its own staff, PBS has exhibited an interest in the broadly developing field of networking and is mindful of the fact that new technical and regulatory developments may directly affect its options in providing the nation's public television stations the flexible interconnection service they require.

While noncommercial educational radio is as old as broadcasting itself, the growth of public radio has been obscured by developments in the world of television. The responsibility to develop public broadcasting as a national service, however, requires that the full potential of the older sound medium be realized as well. Noncommercial radio's dream of a national network is older than those persons now charged with making the dream a reality. Again with impetus provided by the Corporation for Public Broadcasting, 1970 saw the establishment of National Public Radio.

National Public Radio will act as the nexus of national noncommercial radio development, Its initial list of member stations includes those educational radio outlets which serve the needs to the total community in range of their signals. Excluded are noncommercial radio stations whose primary purpose is to serve a college campus as student voice and training ground for future disc jockeys. Noncommercial stations which are primarily evangelistic voices of their church-related licensees or instructional media beaming school programming at classroom audiences are likewise outside the definition of "public radio."

Almost 100 noncommercial stations have the signal strength, the professional staff, and the commitment to serve a general audience which defines public radio. NPR's responsibility will be to develop a national schedule of radio programming through production of new programming and acquisition of programs from such outside sources as the radio networks of other nations. Donald R. Quayle, NPR President, describes the new network as "event-oriented," leaning heavily toward the live coverage of such public affairs as Congressional hearings. NPR also expects to provide meaningful background information, and interpretation of events, drawing upon the insights of journalists and other experts and observers from many points around the country.

To meet such goals, NPR will require an extensive and flexible radio network of Bell System lines, with provision to reach all of the nation's public radio stations, and the capacity to originate programming from many points on the network.

The prospect of new networks for public broadcasting, including both radio and television, ought at very least to suggest to other network planners new participants in a broadened dialogue. Interstate networks, especially those involving state-owned intercity relay, may provide some opportunities for expansion of service. The State of Wisconsin's FM network is made up of stations which are capable of transmitting special non-broadcast communications via multiplexed sub-carrier signals. While the general audience hears the broadcast program, the multiplexed signal is received simultaneously by a smaller audience equipped with special receivers. The Wisconsin network's "background" channel has been used for medical seminars and other communications with professional interest groups. Experiments have also

been undertaken in using the sub-carrier system for the transmission of facsimile graphics.

The National Association of Educational Broadcasters' Council of State Educational Telecommunications Authorities looks toward increased service in nonbroadcast communications. In the mid-1960's the NAEB undertook a broad scale examination of the ways in which educational radio and television networks might become the basis for the development of widely useful educational communications systems.

While not so well known as the Interuniversity Communications Council's report of its 1966 Summer Study on Information Networks [23] the NAEB's Educational Communications System: Phase III presents detailed analysis of three communications system "models," an intra-state model located in Oregon and based upon that state's existing television network; an interstate model projected for the Middle West; and a "resources model" which would tap the information sources in universities, government, and industry in the Boston-Washington corridor for the benefit of the other two model systems.[24]

[24] Brown, George W. et al., EDUNET (New York: John Wiley & Sons, 1967) 440 p.

[25] Witherspoon, John P., et.al., Educational Communication System: Phase III Final Report of Project 450A (Washington, D.C.: Bureau of Research, USOE, October 1966), 300 p.

Two factors common to both EDUCOM's EDUNET, and NAEB's ECS: Phase III, are apparent. One is that each gives clear recognition to the principal that the opportunity to aggregate communications needs can provide the possibility of cost reductions and increased network efficiencies. The concept remains as valid now as it was five years ago. What is also apparent from a re-reading of each study is that the context for educational communications networks has changed substantially. The possibility of new non-telephone microwave networks between cities, the prospect of a domestic communications satellite system, the opportunities for broadband communications via coaxial cable are indications of the ways in which the choices for network planners have been radically increased since these two reports appeared.

Such developments are of especial interest to the Joint Council on Educational Telecommunications. The JCET was founded in 1950 as the Joint Committee on Educational Television. Its concern then was to alert education to the need to secure its options in the emerging communications field of television. Now, the cutting edge (or more accurately,"edges") in communications lie in satellites, cables, and the like. The JCET continues its pursuit of the same goal: to alert the educational community to such developments and to help secure the public benefits which such developments can offer.

The JCET is now, as then, a consortium of nonprofit educational organizations. Its member organizations include the leadership in the educational establishment and in the expanding field of public television which the original JCET helped to establish. That such member organizations as EDUCOM and the Indiana Higher Education Telecommunications System are interested in the broad range of "educational telecommunications" is, like the JCET's present name, indication of increasing recognition of the interdependence of

all types of public service-oriented communications. The JCET serves not only the twenty-five organizations which are its present members, but the total educational community, and beyond it those entities within government and without interested in public communications planning and policy.

The twenty-year experience of the Joint Council on Educational Telecommunications clearly indicates that the enlightened self-interest of those who plan communications networks requires, as does the public interest, that parochialism give way to broader vision, and that acute specialization be tempered with cooperation. Each new development in communications--new technology; new policy decisions to be made by the FCC, the Congress, the White House, the International Telecommunications Union; new programs in communication in such allied fields as public broadcasting and public health--offer an increasingly favorable climate for the development of library communications and other information networks. Library and information specialists can help themselves, and others, if they will seek to pool their interests and cooperate fully in the pursuit of the new opportunities which are now increasingly within our common grasp.